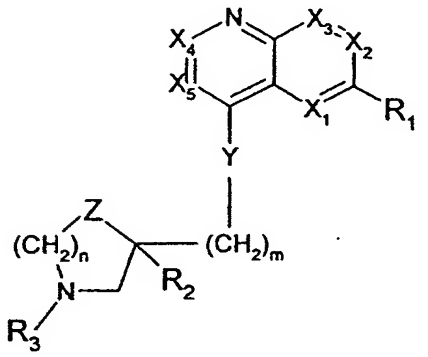
CLAIMS

What is claimed is:

1. A 4-substituted quinoline compound, of formula (I)



(I)

wherein

X_1, X_2, X_3, X_4 and X_5 are C-R'$_1$ to C-R'$_5$ respectively, or alternatively at most one of them is a nitrogen atom,

R_1, R'$_1$, R'$_2$, R'$_3$, R'$_4$ and R'$_5$ are identical or different and are hydrogen or halogen atom or an alkyl, cycloalkyl, phenyl, phenylthio, mono- or bicyclic heteroaryl or heteroarylthio, OH, SH, alkyloxy, difluoromethoxy, trifluoromethoxy, alkylthio, trifluoromethylthio, cycloalkyloxy, cycloalkylthio, acyl, acyloxy, acylthio, cyano, carboxyl, alkyloxycarbonyl, cycloalkyloxycarbonyl, nitro, -NRaRb or -CONRaRb radical (wherein Ra and Rb are hydrogen, alkyl, cycloalkyl, phenyl, mono- or bicyclic heteroaryl or Ra and Rb form together with the nitrogen atom to which they are attached a 5- or 6-membered heterocycle which may optionally contain another heteroatom chosen from O, S and N and carrying, where appropriate, an alkyl, phenyl or mono- or bicyclic heteroaryl substituent on the nitrogen atom or, where appropriate, wherein the sulfur atom is oxidized to the sulfinyl or sulfonyl state), or represent a methylene radical substituted with fluoro, hydroxyl, alkyloxy, alkylthio, cycloalkyloxy, cycloalkylthio, phenyl, mono- or bicyclic heteroaryl, carboxyl, alkyloxycarbonyl, cycloalkyloxycarbonyl, -NRaRb or -CONRaRb wherein Ra and Rb are as defined above,

or represent phenoxy, heterocyclyloxy, benzyloxy, heterocyclylmethyloxy, or alternatively R_1 may also represent difluoromethoxy, or a radical having the structure -C_mF_{2m+1}, -SC_mF_{2m+1} or -OC_mF_{2m+1} wherein m is an integer from 1 to 6 or alternatively R'$_5$ may also represent trifluoroacetyl,

m is equal to 1, 2 or 3;

n is equal to 0, 1 or 2;

Y is CHR, CO, CROH, $CRNH_2$, CRF or CF_2, wherein R is a hydrogen atom or an alkyl (C_{1-6}) radical;

Z CH_2 or alternatively Z isoxygen, sulfur , SO or SO_2 group and, in this case, n is equal to 2;

R_2 is $-CO_2R$, $-CH_2CO_2R$, $-CH_2-CH_2CO_2R$, $-CH_2OH$ or $-CH_2-CH_2OH$, wherein R is as defined above;

R_3 is phenyl, mono- or bicyclic heteroaryl, alk-$R°_3$ wherein alk is an alkylene radical and $R°_3$ is hydrogen, halogen, hydroxyl, alkyloxy, alkylthio, alkylsulfinyl, alkylsulfonyl, alkylamino, dialkylamino, cycloalkyl, cycloalkyloxy, cycloalkylthio, cycloalkylsulfinyl, cycloalkylsulfonyl, cycloalkylamino, N-cycloalkyl-N-alkylamino, $-N-(cycloalkyl)_2$, acyl, cycloalkylcarbonyl, phenyl, phenoxy, phenylthio, phenylsulfinyl, phenylsulfonyl, phenylamino, N-alkyl-N-phenylamino, N-cycloalkyl-N-phenylamino, $-N-(phenyl)_2$, phenylalkyloxy, phenylalkylthio, phenylalkylsulfinyl, phenylalkylsulfonyl, phenylalkylamino, N-alkyl-N-phenylaminoalkyl, N-cycloalkyl-N-phenylalkylamino, benzoyl, mono- or bicyclic heteroaryl, heteroaryloxy, heteroarylthio, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylamino, N-alkyl-N-heteroarylamino,N-cycloalkyl-N-heteroarylamino,heteroarylcarbonyl, heteroarylalkyloxy, heteroarylalkylthio, heteroarylalkylsulfinyl, heteroarylalkylsulfonyl, heteroarylalkylamino, N-alkyl-N-heteroarylaminoalkyl, N-cycloalkyl-N-heteroarylaminoalkyl, (the heteroaryl parts mentioned above being mono- or bicyclic), carboxyl, alkyloxycarbonyl, -NRaRb or -CO-NRaRb wherein Ra and Rb respectively represent hydrogen, alkyl, cycloalkyl, phenyl, mono- or bicyclic heteroaryl, or one of Ra or Rb represents hydroxyl, alkyloxy, cycloalkyloxy, or Ra and Rb form together with the nitrogen atom to which they are attached a 5- or 6-membered heterocycle which may optionally contain another heteroatom chosen from O, S and N and carrying, where appropriate, an alkyl, phenyl or mono- or bicyclic heteroaryl substituent on the nitrogen atom or where appropriate in which the sulfur atom is oxidized to the sulfinyl or sulfonyl state), or alternatively $R°_3$ represents -CR'b=CR'c-R'a wherein R'a is phenyl, phenylalkyl, heteroaryl or heteroarylalkyl wherein the heteroaryl part is mono- or bicyclic, phenoxyalkyl, phenylthioalkyl, phenylsulfinylalkyl, phenylsulfonylalkyl, phenylaminoalkyl, N-alkyl-N-phenylaminoalkyl, heteroaryloxyalkyl, heteroarylthioalkyl, heteroarylsulfinylalkyl, heteroarylsulfonylalkyl, heteroarylaminoalkyl, N-alkyl-N-heteroarylaminoalkyl,

heteroarylthio, heteroarylsulfinyl, heteroarylsulfonyl, (the heteroaryl parts mentioned above being mono- or bicyclic), phenylthio, phenylsulfinyl, phenylsulfonyl, and wherein R'b and R'c represent hydrogen, alkyl or cycloalkyl, or alternatively R_3 represents a radical -C≡C-Rd for which Rd is alkyl, phenyl, phenylalkyl, phenoxyalkyl, phenylthioalkyl, N-alkyl-N-phenylaminoalkyl, mono- or bicyclic heteroaryl, heteroarylalkyl, heteroaryloxyalkyl, heteroarylthioalkyl, heteroarylaminoalkyl, N-alkyl-N-heteroarylaminoalkyl, (the heteroaryl parts mentioned above being mono- or bicyclic), or alternatively $R°_3$ is a radical -CF_2-phenyl or mono- or bicyclic -CF_2-heteroaryl,
it being understood that the phenyl, benzyl, benzoyl or heteroaryl radicals or portions mentioned above are optionally substituted on the ring with 1 to 4 substituents chosen from halogen, hydroxyl, alkyl, alkyloxy, alkyloxyalkyl, haloalkyl, trifluoromethyl, trifluoromethoxy, trifluoromethylthio, carboxyl, alkyloxycarbonyl, cyano, alkylamino, -NRaRb for which Ra and Rb are as defined above, phenyl, hydroxyalkyl, alkylthioalkyl, alkylsulfinylalkyl, alkylsulfonylalkyl,
it being understood that the alkyl or acyl radicals and portions contain (unless specifically stated) 1 to 10 carbon atoms in the form of a straight or branched chain and that the cycloalkyl radicals contain 3 to 6 carbon atoms,
or in its enantiomeric or diastereoisomeric forms or mixtures of these forms, or where appropriate in syn or anti form or mixtures thereof, or its salts.

2. The compound of general formula (I), as defined in claim 1, wherein

X_1, X_2, X_3, X_4 and X_5 are as defined in claim 1,

R_1, R'_1, R'_2, R'_3, R'_4 and R'_5, which are identical or different, are hydrogen, halogen, alkyl, alkyloxy, or a methylene substituted with alkyloxy:

Y represents a radical CH_2, CHOH, CHF, $CHNH_2$ or C=O;

m is equal to 1;

n is as defined in claim 1;

Z is a CH_2 group or oxygen and in the latter case, n is equal to 2;
R_2 is as defined in claim 1, and

R_3 is alk-$R°_3$ wherein alk is an alkylene radical and $R°_3$ is alkyloxy, alkylthio, alkylamino, dialkylamino, cycloalkyloxy, cycloalkylthio, cycloalkylamino, N-cycloalkyl-N-alkylamino, -N-$(cycloalkyl)_2$, phenoxy, phenylthio, phenylamino, N-

alkyl-N-phenylamino, N-cycloalkyl-N-phenylamino, phenylalkyloxy, phenylalkylthio, phenylalkylamino, N-alkyl-N-phenylaminoalkyl, N-cycloalkyl-N-phenylalkylamino, heteroaryloxy, heteroarylthio, heteroarylamino, N-alkyl-N-heteroarylamino, N-cycloalkyl-N-heteroarylamino, heteroarylcarbonyl, heteroarylalkyloxy, heteroarylalkylthio, heteroarylalkylamino, N-alkyl-N-heteroarylaminoalkyl, N-cycloalkyl-N-heteroarylaminoalkyl, -NRaRb or -CO-NRaRb wherein Ra and Rb are as defined in claim 1, or alternatively $R°_3$ represents -CR'b=CR'c-R'a for which R'a represents phenyl, phenylalkyl, heteroaryl or heteroarylalkyl, phenoxyalkyl, phenylthioalkyl, phenylaminoalkyl, N-alkyl-N-phenylaminoalkyl, heteroaryloxyalkyl, heteroarylthioalkyl, heteroarylaminoalkyl, N-alkyl-N-heteroarylaminoalkyl, heteroarylthio, or phenylthio, and for which R'b and R'c is hydrogen, alkyl or cycloalkyl, or alternatively $R°_3$ is a radical -C≡C-Rd wherein Rd is alkyl, phenyl, phenylalkyl, phenoxyalkyl, phenylthioalkyl, N-alkyl-N-phenylaminoalkyl, mono- or bicyclic heteroaryl, heteroarylalkyl, heteroaryloxyalkyl, heteroarylthioalkyl, heteroarylaminoalkyl, N-alkyl-N-heteroarylaminoalkyl, or alternatively $R°_3$ is a radical $-CF_2$-phenyl or $-CF_2$-heteroaryl,
it being understood that the phenyl, benzyl, benzoyl or heteroaryl radicals or portions mentioned above are optionally substituted as envisaged above in claim 1,

or its enantiomeric or diastereoisomeric forms or mixtures of these forms, or where appropriate in syn or anti form or mixtures thereof, or its salts.

3. The compound of general formula (I) as defined in claim 1, wherein

X_1, X_2, X_3, X_4 and X_5 are >C-R'$_1$ to >C-R'$_5$ respectively,

R_1, R'$_1$, R'$_2$, R'$_3$, R'$_4$ and R'$_5$ are identical or different and are hydrogen halogen, alkyl, alkyloxy, or a methylene substituted with alkyloxy;

Y is CH_2, CHOH, CHF, $CHNH_2$ or C=O;

m is equal to 1;

n is as defined in claim 1;

Z is a CH_2 group or oxygen and in the latter case, n is equal to 2;

R_2 is as defined in claim 1, and

R_3 is alk-$R°_3$ wherein alk is alkylene and $R°_3$ is cycloalkyloxy, cycloalkylthio, phenoxy, phenylthio, phenylalkyloxy, phenylalkylthio, heteroaryloxy, heteroarylthio, heteroarylalkyloxy, heteroarylalkylthio, or alternatively R_3 is -CR'b=CR'c-R'a for which R'a represents phenyl, phenylalkyl, phenylthioalkyl, heteroaryl or heteroarylalkyl, phenoxyalkyl, heteroaryloxyalkyl, heteroarylthioalkyl, heteroarylthio, or phenylthio, and wherein R'b and R'c is hydrogen, alkyl or cycloalkyl,
or alternatively $R°_3$ represents a radical -C≡C-Rd wherein Rd is alkyl, phenyl, phenylalkyl, phenoxyalkyl, phenylthioalkyl, N-alkyl-N-phenylaminoalkyl, mono- or bicyclic heteroaryl, heteroarylalkyl, heteroaryloxyalkyl, heteroarylthioalkyl,
the heteroaryl parts mentioned above being mono- or bicyclic,
it being understood that the phenyl, benzyl, benzoyl or heteroaryl radicals or portions mentioned above are optionally substituted as disclosed in claim 1,

or its enantiomeric or diastereoisomeric forms or mixtures of these forms, or where appropriate in syn or anti form or mixtures thereof, or its salts.

4. The compound of claim 1 which is selected from the group cnsisting of:

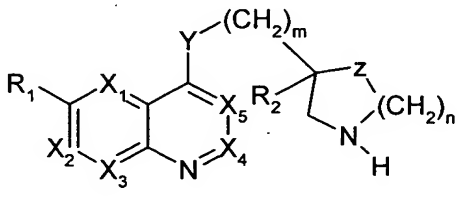
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-hydroxy-(3-fluoro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[2-(2,5-difluorophenylsulfanyl)ethyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[2-(2,5-difluorophenyloxy)ethyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[2-(thiophen-2-ylsulfanyl)ethyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)propyl]azetidine-3-carboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-hydroxy-(3-fluoro-6-methoxyquinolin-4-yl)propyl]azetidine-3-carboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-(3-chloro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-hydroxy-(3-chloro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[2-(2,5-difluorophenylsulfanyl)ethyl]-3-[3-(3-chloro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[2-(2,5-difluorophenyloxy)ethyl]-3-[3-(3-chloro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;

- 1-[2-(thiophen-2-ylsulfanyl)ethyl]-3-[3-(3-chloro-6-methoxyquinolin-4-yl)propyl]-3-pyrrolidinecarboxylic acid;
- 1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)-3-hydroxypropyl]-3-pyrrolidinecarboxylic acid;
- 3-[3-(3-chloro-6-methoxyquinolin-4-yl)]-3-hydroxypropyl]-1-[(2E)-3-(2,5-difluorophenyl)-2-propenyl]-3-pyrrolidinecarboxylic acid;
- 1-[3-(2,5-difluorophenyl)propyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)]-3-hydroxypropyl]-3-pyrrolidinecarboxylic acid, and
- 1-[2-[(2,5-difluorophenyl)thio]ethyl]-3-[3-(3-fluoro-6-methoxyquinolin-4-yl)-3-hydroxypropyl]-3-pyrrolidinecarboxylic acid;

or its enantiomeric or diastereoisomeric forms or mixtures of these forms, or where appropriate in syn or anti form or mixtures thereof, or its salts.

5. A process for preparing a compound of formula (I) as defined in claim 1 comprising:

reacting a 4 substituted quinoline of the formula (II)



(II)

wherein X_1, X_2, X_3, X_4, X_5, R_1, R_2, Y, Z, m and n are as defined in claim 1, wherein R_2 is protected when it carries a carboxyl radical, with a compound of formula (IIa)

$$R_3\text{-}X \quad \text{(IIa)}$$

wherein R_3 is as defined for formula (I) in claim 1 and X is halogen, a methylsulfonyl, trifluoromethylsulfonyl or p-toluenesulfonyl;

removing the carboxyl protecting group, if necessary, to produce the compound of formula (I) as defined in claim 1;

optionally separating the enantiomers or diastereomers of formula (I);

optionally separating the syn and anti forms of formula (I); and

optionally converting the compound of formula (1) into a pharmaceutically acceptable salt.

6. The process according to claim 5 wherein R_3 is –alk-$R°_3$, wherein alk is an alkyl radical, and $R°_3$ is –C≡C-Rd, wherein Rd is as defined in claim 1 comprising:

reacting a compound of formula (II) with an alkynyl compound of formula HC≡C-alk-X, wherein alk is as defined above and X is halogen to give a compound of formula (I) wherein R_3 is HC≡C-alk-; and

substituting the compound of formula (I) wherein R_3 is HC≡C-alk-, with an appropriate radical Rd, to give the compound of formula (I) wherein R_3 is Rd-C≡C-alk-.

7. The process according to claim 5 wherein R_3 is –alk- $R°_3$, wherein alk is an alkyl radical, and $R°_3$ is phenoxy, phenylthio, phenylamino, heteroaryloxy, heteroarylthio or heteroarylamino, comprising:

condensing a chain of formula HO-alk-X wherein X is halogen with a compound of formula (II) to produce a compound of formula (I) wherein R_3 is OH-alk-;

optionally converting the compound of formula (I) wherein R_3 is OH-alk- to the compound of formula (I) wherein R_3 is methanesulfonyl-alk-, halogen-alk- or p-toluenesulfonyl-alk- ; and

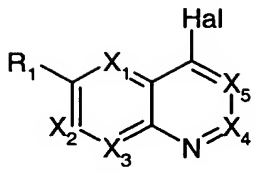
reacting the compound of the previous step with an aromatic compound having the formula $R°_3H$ or $R°_3H_2$ wherein said aromatic compound acts as basic reaction medium or optionally reacting directly said aromatic compound with a compound produced in the first condensing reaction under dehydration conditions.

8. The process according to claim 5 for preparing compound of formula (I) wherein R_3 is hydroxymethyl or hydroxyethyl further comprising:

reducing a compound of formula (I) wherein R_2 is selected from the group consisting of either carboxyl, protected carboxyl, carboxymethyl and protected carboxymethyl.

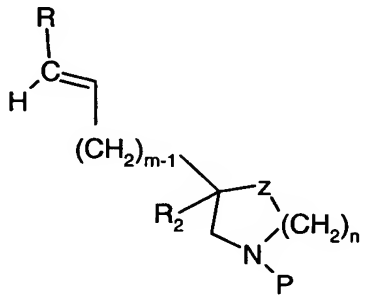
9. The process according to claim 5 for preparing the compound of formula (II), wherein Y is a group CHR comprising:

condensing a compound of formula (III)



(III)

wherein R_1, X_1, X_2, X_3, X_4 and X_5 are as defined in claim 1 and Hal is halogen, with compound of formula (IV)



(IV)

wherein P is a protecting group and R, Z, m, n and R_2 are as defined in claim 1 or R_2 represents a protected radical if R_2 represents or carries a carboxylic acid functional group;

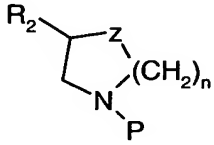
removing the protecting groups;

optionally converting the substituents of the aromatic bicycle of formula (II) thus obtained, to give the expected compound substituted with R_1, R'_1, R'_2, R'_3, R'_4, R'_5; and

optionally removing any remaining protecting groups to give compound of formula (II) wherein R is CHR.

10. The process according to claim 9 for preparing compound of formula (IV) wherein R, Z, P, R_2 and n are as defined in claim 9 and m is equal to 2 or 3 comprising:

reacting a compound of formula (V)



(V)

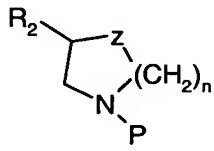
wherein Z and R_2 are as defined in claim 1 and P is a protecting group, with a compound of formula (VI)

$$Hal\text{-}(CH_2)_{m-1}\text{-}CH{=}CHR \qquad (VI)$$

wherein Hal is halogen and m and R are as defined in claim 1.

11. The process according to claim 9 for preparing a compound of formula (IV) wherein R, Z, P, R_2 and n are as defined in claim 9 and m is equal to 1, comprising:

reacting a compound of formula (V)



(V)

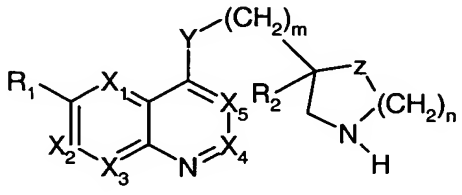
wherein Z and R_2 are as defined above and P is a protecting group, with a compound of formula (VI')

$BrCH_2$-CHRBr (VI')

wherein R is as defined above; and

removing the hydrobromide from the product to obtain compound of formula (IV) wherein wherein R, Z, P, R_2 and n are as defined in claim 9 and m is equal to 1.

12. A compound of formula (II)



(II)

wherein

X_1, X_2, X_3, X_4 and X_5 is C-R'$_1$ to C-R'$_5$ respectively, or alternatively at most one of them is a nitrogen atom,

R_1, R'$_1$, R'$_2$, R'$_3$, R'$_4$ and R'$_5$ are identical or different and represent a hydrogen or halogen atom or an alkyl, cycloalkyl, phenyl, phenylthio, mono- or bicyclic heteroaryl or heteroarylthio, OH, SH, alkyloxy, difluoromethoxy, trifluoromethoxy, alkylthio, trifluoromethylthio, cycloalkyloxy, cycloalkylthio, acyl, acyloxy, acylthio, cyano, carboxyl, alkyloxycarbonyl, cycloalkyloxycarbonyl, nitro, -NRaRb or -CONRaRb radical (for which Ra and Rb can represent hydrogen, alkyl, cycloalkyl, phenyl, mono- or bicyclic heteroaryl or Ra and Rb form together with the nitrogen atom to which they are attached a 5- or 6-

membered heterocycle which may optionally contain another heteroatom chosen from O, S and N and carrying, where appropriate, an alkyl, phenyl or mono- or bicyclic heteroaryl substituent on the nitrogen atom or, where appropriate, wherein the sulfur atom is oxidized to the sulfinyl or sulfonyl state, or methylene substituted with fluoro, hydroxyl, alkyloxy, alkylthio, cycloalkyloxy, cycloalkylthio, phenyl, mono- or bicyclic heteroaryl, carboxyl, alkyloxycarbonyl, cycloalkyloxycarbonyl, -NRaRb or -CONRaRb wherein Ra and Rb are as defined above,

or is phenoxy, heterocyclyloxy, benzyloxy, heterocyclylmethyloxy, or alternatively R_1 may also be difluoromethoxy, or a radical having the structure $-C_mF_{2m+1}$, $-SC_mF_{2m+1}$ or $-OC_mF_{2m+1}$ for which m is an integer from 1 to 6 or alternatively R'_5 may also be trifluoroacetyl,

m is equal to 1, 2 or 3;

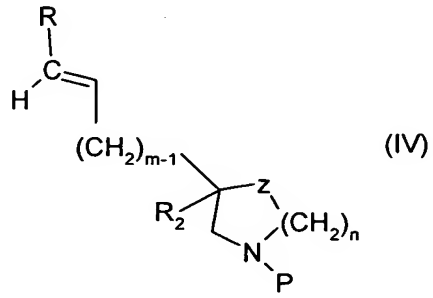
n is equal to 0, 1 or 2;

Y is CHR, CO, CROH, $CRNH_2$, CRF or CF_2, wherein R is hydrogen atom or alkyl (C_{1-6});

Z is CH_2, oxygen, sulfur, SO, or SO_2 and, in this case, n is equal to 2; and

R_2 is $-CO_2R$, $-CH_2CO_2R$, $-CH_2-CH_2CO_2R$, $-CH_2OH$ or $-CH_2-CH_2OH$, wherein R is as defined above.

13. A compound of formula (IV)



(IV)

wherein

R is hydrogen or an alkyl (C_{1-6});

m is equal to 1, 2 or 3;

n is equal to 0, 1 or 2;

Z is CH_2, oxygen, sulfur, SO or SO_2 and, in this case, n is equal to 2; and

R_2 is $-CO_2R$, $-CH_2CO_2R$, $-CH_2-CH_2CO_2R$, $-CH_2OH$,$-CH_2-CH_2OH$, or a protected carboxylic acid, wherein R is as defined above.

14. A method for the treatment or prophylaxis of bacterial infections comprising administering to a patient in need of said treatment an effective amount of a compound according to claim 1 or a pharmacologically tolerable salt thereof.

15. A pharmaceutical composition, or a pharmacologically tolerable salt thereof comprising a compound of claim 1, in the pure state or in combination with one or more compatible and pharmaceutically acceptable diluents or adjuvants.